

Remarks

Claims 4 and 10 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that the applicants regard as the invention. Claims 4 and 10 are now amended to provide sufficient antecedent basis. A marked-up copy of the claims is attached. Withdrawal of the §112 rejection of these claims is therefore respectfully requested.

Claims 1-20 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Hartley et al., U.S. Patent No. 4,853,737 ("Hartley"), and incorporated by reference, Lentz, U.S. Patent No. 4,257,699 ("Lentz"), in view of Schlueter, Jr. et al., U.S. Patent No. 5,995,796 ("Schlueter"). This rejection is respectfully traversed.

Claim 1 is amended to recite that the curing of the layer of the coating composition on the support for 5 to 10 hours is carried out at a temperature in the range of 25°C to 120°C. New claim 21 states that the curing is effected at a temperature of 25°C to 50°C, and new claim 22 specifies that the curing temperature is 25°C. The amendment of claim 1 and new claims 21 and 22 are supported by the specification at page 14, lines 9-13, and by Examples 1 and 2.

The three cited references, Hartley, Lentz and Schlueter, all teach fuser rolls containing release layers formed from cured fluoroelastomers, for example, VITON™ elastomers. Such materials are characterized by relatively high surface energies, which causes them to have less than optimum toner release properties, resulting in undesirable offset of the toner onto the fuser roll.

By contrast to the release layers disclosed in the cited references, a fuser member prepared by the method of the present invention includes a release layer formed from a coating composition comprising a fluorocarbon thermoplastic random copolymer having subunits of $-(CH_2CF_2)_x-$, $-(CF_2CF(CF_3))_y-$, and $-(CF_2CF_2)_z-$. Suitable thermoplastic polymers, which are also disclosed in the cross-referenced application Serial Nos. 09/609,562 and 09/608,362, now U.S. Patent Nos. 6,372,352 and 6,355,352, respectively, are commercially available under the designation "THV Fluoroplastics", as discussed at page 12, line 22, to page 13, line 6 of the instant specification. As further described in the specification at page 7, lines 19-23, addition of zinc oxide filler and an aminosiloxane polymer to fluorocarbon thermoplastic random copolymers used in fuser members imparts improved mechanical strength and toner release.

Hartley teaches that curable fluoroelastomer compositions employed to form a fuser roll outer layer may optionally contain a filler or a mixture of fillers selected from a large variety of metal oxides, metal salts, metals, metal alloys, and other metal compounds (cf. column 6, line 28, to column 7, line 34).

Hartley further teaches that the curing of the fuser roll outer layer is preferably carried out, at least in part, at temperatures of at least 230°C, typically by gradually raising the temperature from about 20°C to about 230°C over a period of about 12 to 24 hours, and then holding at that temperature or slightly higher, e.g., 232°C for about 24 hours (cf. column 8, lines 26-33).

It was noted on page 3 of the Office Action that "Hartley further teaches that one skilled in the art can compare the release of various cured elastomers containing the metal oxides to determine the optimum metal oxide or combination thereof and concentrations thereof. See column 6, lines 49-53." The reference, however goes on, at column 6, lines 53-68, to teach that specific fillers may be selected for their ability to interact with the functional groups of polymeric release agents, to participate in the dehydrofluorination reaction (lead oxide used alone without another filler being mentioned as preferred for this purpose), or to improve thermal conductivity (oxides of copper, silver, or gold being listed as beneficial for this purpose). There is no suggestion in Hartley that a metal oxide, or a combination of oxides, can be employed to enable low temperature curing of the fluoroelastomer layer, as provided by the present invention.

The teachings of Lentz regarding curable fluoroelastomer compositions that include fillers selected from among metal oxides, metal salts, metals, and metal alloys are generally similar to those of Hartley. Lentz repeatedly emphasizes throughout the specification that the metal-containing filler is selected for its ability to interact with the functional groups of the polymeric release agent applied to the fuser member surface layer. As with Hartley, there is no suggestion in Lentz that a metal oxide, or a combination of oxides, can be used to enable low temperature curing of the fluoroelastomer layer.

In contrast to Hartley, Lentz does not mention specific conditions for curing the fuser member surface layer. However, Example VI of the latter reference describes the curing at 232 °C for 24 hours of a fluoroelastomer layer containing only trace amounts of a metal filler.

Schlueter discloses an electrostatographic film component having a polymeric layer that includes a doped metal oxide, preferably antimony-doped tin oxide, and may optionally further contain an additional filler such as carbon black, graphite, boron nitride, or various metal oxides such as oxides of iron, magnesium, aluminum, copper, tin, titanium, zinc, chrome, nickel, and mixtures thereof.

Schlueter teaches that the antimony-doped tin oxide is included in the polymeric layer in an amount necessary to achieve a desired surface resistivity. The reference does not specify the curing conditions for the polymeric layer containing the doped metal oxide filler, simply mentioning that air dried coatings were subjected to a "step heat cure" for approximately 24 hours (column 13, lines 12-14).

Fuser rolls commonly include a cushion layer, typically formed from silicone rubber, between the substrate and the release layer. As taught at page 4, lines 26-32, of the instant specification, curing of a fluoroelastomer release layer at high temperature can lead to damage to the cushion layer caused by depolymerization of the silicone rubber. As remarked at page 7, lines 23-25, the applicants have made the surprising finding that the addition of antimony tin oxide particles to a toner release layer containing a fluorocarbon thermoplastic random copolymer, a curing agent, zinc oxide particles, and an aminosiloxane significantly reduces the temperature required for curing.

A comparison of the results of storage modulus measurements at various temperatures on the films of Examples 1 and 2 and Comparative Example 1, summarized in Table 3, clearly demonstrates the beneficial increase in storage modulus that results from the inclusion of antimony-doped tin oxide particles in the coating composition of the present invention.

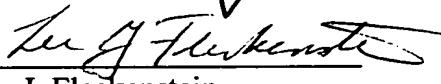
Claim 1, as amended, recites that the curing temperature is in the range of 25°C to 120°C. A curing temperature in the range of 25°C to 50°C is recited in new claim 21, while new claim 22 states that the curing temperature is 25°C. In the Office Action, it was stated, citing *In re Aller*, that "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." However, *In re Aller* is clearly not applicable to this case. The method of the present invention requires that curing of the layer coated on the substrate be carried out at a temperature in the range of 25°C to 120°C for 5 to 10 hours. These ranges of temperature and time lie well outside the curing conditions taught by Hartley: raising the temperature from about 20°C to about 230°C over about

12 to 24 hours, then holding at about 230°C for another 24 hours. Furthermore the cited references, considered separately or in combination, in no way render obvious the applicants' surprising discovery that the inclusion of antimony-doped tin oxide together with zinc oxide in the fluorocarbon thermoplastic copolymer coating composition enables its curing at beneficially low temperatures.

In light of the foregoing amendments and the discussion, in which the fluorocarbon thermoplastic random copolymers of the present invention are clearly distinguished from the fluoroelastomers disclosed in the cited references, withdrawal of the §103(a) rejection of claims 1-20 is respectfully requested. Claims 1- 22 are now in this case, whose prompt allowance is earnestly solicited.

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Respectfully submitted,


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Marked-Up Copy of Claims

1. (Amended) A method of making a fuser member having a support comprising the steps of:

A) providing a support;

B) coating [from] a coating composition contained in an organic solvent onto the support, thereby forming a layer of the coating composition on said support, [a] said coating composition comprising a fluorocarbon thermoplastic random copolymer, a curing agent having a bisphenol residue, a particulate filler containing zinc oxide, antimony-doped tin oxide particles, and an aminosiloxane, the fluorocarbon thermoplastic random copolymer having subunits of:

—(CH₂CF₂)_x—, —(CF₂CF(CF₃)_y—, and —(CF₂CF₂)_z—,

wherein

x is from 1 to 50 or 60 to 80 mole percent,

y is from 10 to 90 mole percent,

z is from 10 to 90 mole percent,

x + y + z equals 100 mole percent; and

C) curing said layer of the coating composition on said support for 5 to 10 hours at a temperature in the range of 25°C to [275] 120°C.

4. (Amended) The method of claim 1 wherein the [amino siloxane] aminosiloxane has a total concentration in the [layer] coating composition of from 1 to 20 parts by weight per 100 parts of the fluorocarbon thermoplastic random copolymer.

10. (Amended) The method of claim 1 further [including] comprising:
forming a cushion layer between [the core] said substrate and [the] said layer of the coating composition.